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The Advanced Traceability and Control System Performance Data Analysis

by

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ABSTRACT

The purpose of this thesis is to determine the actual time measurements associated with the various steps of the Advanced Traceability and Control (ATAC) process to evaluate significant policy decisions such as the Defense Management Review Decision (DMRD) 901's "ship or hold" decision. As the first step, a review of the operation of ATAC is presented. Additionally the ATAC Plus program, which represents the future of Navy carcass management, is described. Next, the data base maintained by Navy Material Transportation Office (NAVMTO) is analyzed and the results are presented. Further research is recommended to develop an elaborate simulation model to allow the development of a comprehensive processing policy for each repairable item.

C.1

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I. INTRODUCTION

A. BACKGROUND

In 1986, the United States Navy implemented the Advanced Traceability and Control (ATAC) system to manage the repairable return process. Under the ATAC system, failed Depot Level Repairable (DLRs) are processed through ATAC HUBs before being shipped to the Designated Overhaul Point (DOP) for repair, or stored at the Designated Support Points (DSPs). The ATAC HUBs receive, identify, package, and transship or stow these retrograde DLRs. The purpose of these efforts is to improve accountability and visibility of the carcasses in the repair pipeline, to reduce the number of units of an item in the pipeline and to reduce the length of the pipeline. Additional benefits provided by the ATAC system include transportation savings through the consolidation of shipments from the HUBs, labor and processing cost savings gained through computerization and bar-code processing and by consolidating resources at the HUBs.

In the current budgeting climate of decreased funding, the Department of Defense issued the Defense Management Review Decisions (DMRDs) directed at improving the efficiency of logistics support activities throughout the military. DMRD 901 challenged the Navy way of returning failed DLRs.

DMRD 901 states that transportation dollar savings would be significant if all carcasses were held for some period of time at the first point of turn-in to the supply system [Ref. 1:p. 8-10]. The goal of this statement is to save money by only shipping failed DLRs that have an immediate repair requirement determined by a review of the item by an inventory manager at an Inventory Control Point (ICP). A basic assumption of DMRD 901 is that most carcasses will never need to be repaired because there will be no demand for them. Unfortunately, this assumption is not correct for many Navy DLRs. In fact, the Navy has successfully argued against DMRD 901 for items with an expected requirement in the next 2.5 years. Items within this category are now processed through the HUBs and sent directly to the DOP or DSP. The rest of the carcasses are held at the initial point of turn-in or the HUB.

Kevin Fitzpatrick, NAVSUP Code 0631 in 1989, [Ref. 2] developed an average flow cost analysis of the proposed DMRD 901 changes. He assumed a linear aggregate break-even model that compared the current ATAC process with the changes proposed by DMRD 901. The first turn-in points in his analysis were assumed to be the HUBs at San Diego and Norfolk. He concluded that it would not be economical to hold carcasses at the HUBs if at least 30 percent would require immediate redistribution.

A major problem with his analysis was that it did not consider the stochastic nature of the failure and carcass return process.

Even so, he pointed out various problems associated with DMRD 901 which would be magnified if the stochastic nature of the processes were considered:

1. The inability of ATAC HUBs to create additional storage space to accommodate the increased storage requirements DMRD will generate.

2. Increased pipeline requirements while awaiting repair decisions and redistribution orders from the inventory manager at the ICP.

3. Increased labor costs at HUBs may offset transportation cost savings.

4. Increased accountability and control problems with material intransit. [Ref. 2]

In 1990, Captain Paul Tully, then NAVSUP Code 06, realized that an average flow model would not reflect the depth of the storage problem that would be experienced at the HUBs and DSPs if DMRD 901 was implemented. He also wanted the 2.5 years dividing line between shipping and holding carcasses to be investigated using a stochastic model. He asked Dr. McMasters to consider the problem as a stochastic process in the summer of 1990 [Ref. 3]. McMasters initial modelling using queuing theory, found that, under the assumption of Poisson arrivals and constant or exponentially distributed service times stockpiles of carcasses would quickly build up at the HUBs, DOPs and DSPs. He also illustrated the importance of understanding the relationship between depot service rates and

carcass arrival rates before making decisions about the repairable shipping problem. His results are reported in the thesis of Harris and Munson [Ref 4:p40-43].

This thesis is part of the research proposed to NAVSUP by McMasters [Ref. 4] in response to Captain Tully's request. He suggested three levels of effort to develop a model for analysis of the carcass return process.

Level I involves building an aggregate model of the Navy carcass return system, with an average type carcass reflecting average characteristics of repairable in the Navy system. The carcass routing would be quite simplified. Carcass arrivals would be assumed to be Poisson distributed and service times would be assumed to be constant or follow an exponential distribution. The result would be a simple steady-state cyclic queuing model or a simple simulation model which could be used to determine which parameters are most important to decisions about shipping immediately or waiting until a repair requirement is generated.

Level II involves the determination of realistic probability distributions for demand, repair time, processing and transportation times to apply to the average type of carcass and simplified carcass routing model of Level I.

Level III proposes a much more elaborate model, involving a detailed realistic simulation model of the ATAC system that would provide answers to many different policy questions. This model would reflect a detailed understanding of each

stage in the process and would incorporate real-world probability distributions for those stages characterized by random times. All of the costs (including transportation, storage, receipt and issue, disposal, holding, administrative repair order and depot repair costs) and decision variables (such as carcass return routing, storage at each location, shipment consolidation, disposal decisions and repair induction control rules) would be incorporated in the model. The goal would be to develop a comprehensive processing policy for each repairable item.

Jacobs and Dryer's thesis [Ref. 5] was an attempt at Level I of this modeling process. They developed a simple simulation model using a very simplified carcass routing process and limited data. The major problem they faced was acquiring and then validating data. They requested and received historical data tapes from the system manager. When this first set of tapes was examined it was determined to only cover open records. An open record is one where an item is entered into the ATAC system but its processing to a DOP or DSP is never recorded in the data base. After these problems were discovered, they requested additional tapes, and received them too late for inclusion in their thesis.

Before extending the research into Level II of McMasters' proposal, an adequate data base would need to be found and the data validated to determine if there was a sufficient quantity of data available to justify further research.

Jacobs and Dryer's second set of tapes were examined and provide the data necessary to continue McMasters' proposed research. These tapes are the source of the data for the author's thesis.

B. OBJECTIVE

The objective of this thesis is to separate the various steps in the ATAC repairable carcass return process, to document the performance for the ATAC system in the aggregate and to see if the data could aid in future modeling efforts of seeking to answer the question of the 2.5-year dividing line. The data and the subsequent models could also be used to determine what other factors are most important in determining if a carcass should be shipped immediately to a DOP or held until a repair requirement is generated.

C. RESEARCH QUESTIONS

The following specific questions were developed to achieve the above objective:

1. Is there accurate and detailed data available in the ATAC data base? Accurate data that provides the ability to trace an item as it flows through the repairable pipeline, is necessary to develop alternative processing priorities for individual items.

2. What are the current ATAC operating procedures? Do problems exist in the system? Is anything being done to solve existing problems or improve ATAC performance? An understanding of the system operating procedures is essential to analyzing the data.

3. What are the major steps in the repairable return process, does the data base allow them to be isolated and how long does each step take?

4. Can a simulation model of the ATAC system be developed from this data to determine the effects of changes proposed by DMRD 901?

D. ORGANIZATION OF THE THESIS

Chapter II is an overview of the ATAC process based on the author's research and previous studies of the process [Refs. 2,5&6].

Chapter III provides a brief discussion of the ATAC data base, a listing of the processing steps measured and a summary of the ATAC Data Base Plus Project.

Chapter IV is an explanation of the individual steps measured and a presentation of the actual performance data for the ATAC carcass return process.

Chapter V presents a summary of the thesis, conclusions drawn from the research, and recommendations for further analyses.

II. THE ATAC SYSTEM

The first step in measuring a complex process like the ATAC system is to understand how the process works. This chapter will provide the goals of the ATAC system and a description of the positioning and movement of DLR carcasses. A thorough understanding of this process will form the basis for the data analysis described in Chapter IV.

The primary goals of the ATAC system are [Ref. 6]:

1. Reduce the retrograde time (pipeline) by providing for faster movement of DLR carcasses being returned for repair.

2. Ensure visibility and accountability for all returned carcasses.

3. Consolidate shipments to reduce transportation costs.

4. Reduce labor resources through economies of scale achieved at the HUBs.

5. Develop centers of excellence at the two HUBs to minimize DLR processing costs.

In the ATAC system the Navy provides a centralized DLR technical screening process and utilizes the functions of a commercial freight agent to increase the traceability and movement of repairable carcasses from the point of failure to the repair DOP or DSP.

Repairable carcasses flow through the system in two ways. Both methods start when an item fails at a Naval activity and the activity determines it can not repair the part locally.

The first option for returning failed components is to send them directly to the nearest HUB. This can be done by delivering the component to the HUB, if it is located in the vicinity of the activity, or by sending it to the HUB by certified mail. Once the item is received at the HUB, the HUB verifies the material, determines its disposition, and ships it to a DOP for repair or to a DSP for storage.

The second option is for the Naval activity experiencing the failure to transfer the component to the local supply activity that acts as a NODE. The NODE acts basically as a transportation consolidation point, forwarding consolidated shipments of failed components to the closest HUB for screening and disposition.

The ATAC system works on a first-in, first-out basis and all items receive the same treatment. The Navy's Issue Priority Group system, the urgency of need, and the cost of the item are not used to create a priority system for handling returned carcasses.

The following subsections provide details on the various steps a failed component is processed through in the ATAC system, including the information processing completed at each step.

A. NODES

Unless failed components are delivered directly to a HUB, NODES are the first point of receipt for material into the

ATAC system. NODES consolidate failed components and ship them to the nearest HUB for processing.

Being the point of entry into the ATAC system, the NODE is the first place where management information gets recorded into the ATAC data base. The initial data entered into the data base by NODE personnel are the document number and National Stock Number (NSN) for the failed component. This information is also printed on bar-code labels and attached to each item.

Contractor-operated NODES are funded by NAVSUP at the following high volume sites: Charleston, SC; Pensacola, FL; Jacksonville, FL; Corpus Christi, TX; Bremerton, WA; Oakland, CA; Long Beach, CA; Cherry Point, NC; Pearl Harbor, HI; Yokosuka, Japan; and Sigonella, Sicily, Italy.

B. HUBS

There are two HUBS; Norfolk, VA and San Diego, CA. When material arrives at a HUB it passes through the following steps:

1. Receiving
2. Screening
3. Processing
4. Packing
5. Shipping

Failed DLRs are received by an ATAC contractor freight agent, turned over to the Navy HUB personnel for screening,

processing through the Master Repairable Item List (MRIL), and packing, then returned to the ATAC freight agent for consolidation before shipment by a contractor carrier.

1. Receiving

The HUB process starts when the HUB contractor receives a shipment from a NODE through the mail or locally delivered by the originating activity. The first step is a visual screen of the material to determine if it is really a DLR and if it is hazardous material but not labeled hazardous. The documentation is also reviewed at this time to check for ATAC excluded material. Material may be excluded from the ATAC system for economic (the item is usually very expensive), security, or safety reasons [Ref. 4:p. 52]. Excluded items received at the HUBs are immediately turned over to the Navy personnel for handling outside of the ATAC system. A list of excluded items is provided in Appendix A.

At the HUB the document number and NSN of each ATAC eligible carcass is entered into the data base. This provides management with the capability to determine if any carcasses processed through a NODE have failed to arrive at the HUB, and creates a record for items being delivered directly to the HUB via mail or local delivery. Additionally, it provides a starting point for HUB processing time measurements and allows for the calculation of transportation times from NODES to the HUB.

The ATAC contractor then reviews each item to determine if the required bar code label is still attached. For direct delivery items or items with missing labels, new ones will be created and applied to the items.

In the next step, the material is separated onto pallets or into portable bins, and a manifest of each container is created. Each manifest lists multiple carcasses. The material and the manifests are then turned over to the Navy representatives for screening and the date of this transfer is recorded in the ATAC data base.

2. Screening

After receiving the material from the ATAC contractor, the Navy personnel's first step is to process it through the Parts Master work station. The NSN is scanned into the Parts Master data base which provides important data and management information pertaining to each item, such as part number and manufacturer. This information is attached to the item to assist the screeners in the next step. One of the primary purposes of screening is to ensure that the item received is identified correctly. The part number provided by the Parts Master printout is compared to the part number on the DLR. If there is no part number on the item or the numbers don't match, further research is required to continue processing this item. The additional research includes a search of various microfiche and related technical publications

(Aircraft Illustrated Parts Breakdowns are a good example) [Ref. 5:p.14]. If the part is identified but the documentation is incorrect, or the part cannot be identified a Report of Discrepancy (ROD) is created and sent to the originating activity for identification and to the ICP for carcass tracking purposes. This process is done to correct mistakes and avoid additional discrepancies with future items.

3. Processing

After screening, the next step is determining the disposition for the item. Once disposition is determined, a shipping or stowage document must be created. A mechanized MRIL is used to accomplish this. The MRIL contains disposition information for each DLR; such as Material Control Code, Movement Priority Designator, special shipping and handling requirements and, most importantly, the "where-ship-to" address. The MRIL is updated monthly by the Fleet Material Support Office (FMSO) based on information provided by the item managers from the ICPs.

The MRIL operator scans each part's bar coded NSN into the MRIL program. A shipping document (DD Form 1348-1) or a local stowage/disposal document is then automatically produced for most items. Items destined for transfer to activities participating in the Advanced Shipping Program are handled somewhat differently.

The Advanced Shipping program is unique to Navy activities using the Uniformed Automated Data Processing System - Stock Point (UADPS-SP). All Navy DSPs participate in this program. In this program a Material Movement Document (MMD) is attached to the item. This MMD includes the shipping address and specific storage location at the receiving activity. This process allows for faster storage at the DSP and saves money by eliminating the requirement for additional screening for a storage location, and processing by receiving personnel at the DSP. The material is actually delivered directly to the warehouse it will be stored at, bypassing the central receiving facility at the DSP.

4. Packing

The next step in the process is to prepare the item for shipment or for local stowage. The material is moved to the packing station and separated into categories. Items requiring transshipment are appropriately packaged for shipment and the shipping label is attached. Material not requiring shipment will be sent directly to local stowage or disposal.

5. Shipping

Material requiring shipment to a DOP/DSP is returned to the ATAC contractor for consolidation and shipment. The steps in this process are:

1. The transfer of custody from the Navy to the contractor is recorded in the ATAC data base.

2. Material is consolidated for each shipment destination.

3. A bar-code shipping label containing the lead Transportation Control Number (TAN), number of pieces, weight and destination is produced and attached to the shipping container.

4. The ATAC contractor turns the material over to the Guaranteed Traffic Award (GTA) carrier for shipment.

5. The GTA carrier delivers the material to the DOP's central receiving area.

III. THE ATAC DATA BASE

A. BACKGROUND

The ATAC data base is managed by the Navy Material Transportation Office (NAVMTO). The data base is officially called the Naval Computer and Telecommunications Area Master Station Lant (NCTAMS LANT) ATAC data base. This data base tracks the movement and storage for all failed repairable managed in the Navy system. One supply analyst, Mr. Paul Barraco, NAVMTO Code 033B, is assigned to maintain this large and complex system. He monitors the system and extracts the required data when needed by NAVSUP to measure ATAC performance. He also provided the historical data used in this thesis. [Ref. 7]

During the course of their research, Jacobs and Dryer requested the actual tape records from the 1991 data base from Mr. Barraco [Ref. 5:p. 57-58]. They had planned to use the tapes to run sample statistics to use in their model. They were unable to do this because the tapes were delayed due to a funding problem. Four tapes were finally received. One of the four contained very few records. The other three were used as the data sources for this thesis.

B. ATAC SYSTEM PROCESSING DELAYS

The initial examination of the tapes showed that they contained records of covered DLR carcass arrivals at both ATAC HUBs from the period October, 1990 to July, 1991. This time period included emergent demand for repairable items generated by Operation Desert Shield/Storm. The tapes included over 600,000 records and provided enough data to measure the performance of the ATAC system to the level desired for this thesis. That includes measuring the average demand on the system, processing time through the various steps in the system, and the transportation times to a HUB from an originating activity and from the HUB to the DOP.

Using FORTRAN, times for each of the following steps or stages of the ATAC repairable return process were calculated:

1. Direct shipment from originating activity to a HUB.
2. Shipment from originating activity to a NODE.
3. NODE consolidation and processing time.
4. Shipment from a NODE to a HUB.
5. Average number of daily arrivals at a HUB.
6. HUB agent receipt and turnover processing time.
7. Navy screening to local storage time.
8. Navy screening and packing time for items being shipped.
9. Shipment consolidation time at the HUB.
10. Shipping time from HUB to DOP.

The above measurements are presented in days because the data base only recorded whole days as the unit of time recorded.

A value of 0 in any category means that step of the processing was completed the same day that the DLR arrived at that stage. For DLR carcasses processed the day of arrival, this author assumed four hours or 0.5 days as the processing time, because a zero processing time value is not realistic.

In Chapter IV the measurements for each stage listed above is described and the statistical analysis is presented. The observations from each tape was analyzed separately, and then combined to get an aggregate total. For each step, the mean and frequency distributions were computed. When this was completed Chi-square goodness-of-fit tests were attempted on each series of data to determine if the data could be estimated by well-known probability distributions for future use in simulation or other modeling methodology. Unfortunately, the goodness-of-fit tests were inconclusive and didn't indicate that the data could be represented by any common probability distributions. Perhaps analyses of the ATAC data base by future researchers may have better luck.

C. ATAC DATA BASE PLUS

The future form of the ATAC program will be the ATAC Data Base Plus system. The purpose of ATAC Plus is to improve the existing carcass tracking system, particularly for deployed ships and Marine units. When implemented (expected by 1994), ATAC Plus will provide the real-time capability to monitor and expedite DLR shipments from the original point of turn-in through receipt of the item at the DOP.

1. Current System Weaknesses

a. Incomplete Visibility of Carcasses in the Pipeline

The original point of turn-in is the supply department of the ship on which the failed part was replaced. A deployed ship has two options for returning retrograde material. The ship can mail the carcass to the HUB or transfer it to a Combat Logistic Force (CLF) ship for further shipment. The current ATAC system can not track either turn in method. In the existing ATAC system, the ICP's first visibility of a retrograde DLR in the pipeline is when it arrives at the HUB. DLRs that are turned in through a NODE are shipped and tracked by the National Transportation System until they arrive at the HUB. In the present system, the ICPs have no routine way to access this data base or track carcasses until they arrive at a HUB.

This lack of visibility until an item arrives at a NODE or HUB and the limited visibility thereafter makes

expediting critical requirements a difficult process. Shipments must be located manually by phone, fax or message and manually processed through the system. This is time-consuming and expensive. This fragmented visibility is one of the problems ATAC Plus is designed to overcome. [Ref. 8:p. 1-4]

b. Lessons Learned from Desert Storm

The operational tempo and the harsh environmental conditions experienced during Operation Desert Storm dramatically increased aircraft engine and component failure rates experience by Navy aircraft [Ref. 8:p. 4]. This, in turn, generated the requirement for more carcasses to repair which led to increased production schedules at Navy DOPs. This increased demand along with a lengthened retrograde return pipeline created the need to expedite the movement of some critical carcasses. The lengthened pipeline was caused by increased competition for limited transport capacity and the distance from South West Asia to the United States.

During Desert Storm, failed carcasses were generally transported along the following route. Failed engines and components were delivered to Bahrain via Navy or Marine Corp organic transportation. From Bahrain they were air-lifted to Sigonella via the National Transportation System. Once in Sigonella, they were delayed in the strategic air lift channel due to the problems discussed above. To

overcome these delays, the Aviation Supply Office asked NAVMTO to expedite transshipment from Sigonella to the ATAC HUB in Norfolk. NAVMTO was unable to do this because there was no way to monitor these assets as they passed through the channel to the HUB. This system deficiency is another problem ATAC Plus is designed to correct.

2. Project Description

When completed, the ATAC Plus project will eliminate the gaps in the current retrograde flow visibility and convert all transportation and supply transactions that update the various bases to an electronic data interchange (EDI) system. Implementation of the project has been scheduled in the following three phases.

1. Phase I - Data base integration
2. Phase II - Afloat hardware and software
3. Phase III - Navy organic EDI translation capability

Each of these phases is discussed below.

a. Phase I - Data Base Integration

Phase I will integrate all retrograde information into the ATAC Plus data base. When this is completed, users with access authority to ATAC Plus will be able to view the current status of any retrograde item via the Naval Logistics Network. This will also include carcasses moving within the National Transportation System.

The expanded data base will allow item managers better control over critically required items. Additionally, managers and planners at the various overhaul points will be able to use this visibility to schedule work more efficiently and to order the needed bit and piece parts sooner. Bit and piece parts are usually ordered after the carcass is received and their leadtimes are included as part of the repair turnaround time. If the new system works as planned, the turnaround time for the component should be shorter. If the turnaround time decreases, the inventory requirement for ready for issue DLRs to support the pipeline should also decrease. This can be explained by Little's Law which states that the inventory level equals the failure rate times the turnaround time. Therefore, the investment required to support the system will be lower and the Navy can expect to save money. Phase I is scheduled for completion in FY92.

b. Phase II - Afloat Hardware and Software

This phase will provide aviation-repair capable ships and CLF ships with the ability to transmit to and to receive information from the ATAC Plus data base. This capability will come from Automated Transportation Data Base and International Maritime Satellite (INMARSAT) telecommunications equipment installed onboard. This system will extend the carcass tracking system to the time a failed DLR is first turned in to a ship's supply department and will greatly enhance the item manager's ability to expedite critical material.

Phase II requires the procurement of micro-computers and satellite transmission equipment which is expected to take approximately four years.

c. Phase III - Navy EDI Capability

Phase III will allow all the players in the retrograde pipeline to exchange the supply and transportation transactions in EDI formats. This phase is scheduled to be implemented in FY92. The goal of this phase is to eliminate the current requirement for the government to maintain over 120 micro-computers at various contractor facilities. These computers are used to transmit retrograde processing information to the ICPs. Additionally, Phase III will eliminate the requirement for data to be entered twice by contractor personnel, once in their system and once in the Navy's.

3. Project Summary

ATAC Plus will establish an EDI Network that provides full visibility of DLR carcasses from the failure time at the end-use activities until receipt at the DOP. With ATAC Plus the Navy can [Ref. 8:p. 8]:

- Improve the accountability of DLRs;
- Improve the efficiency of the supply/transportation system;
- Improve depot parts forecasting, production planning, and work load scheduling; and
- Reduce work loads by automating the manual tracking process.

IV. ATAC SYSTEM DATA ANALYSIS

A. OVERVIEW

In this chapter, the ten steps of the ATAC process listed in Section B of Chapter III will be described in detail and the data extracted from the ATAC data tapes will be presented. The goal of this chapter is to provide the actual time measurements associated with the various steps of the ATAC process. These statistics provide an evaluation of the process. This has not been done since ATAC was instituted. The statistics can be used as a baseline to suggest and/or compare proposed changes in the ATAC system.

The individual sections discuss data for the ATAC system in the aggregate; i.e. an individual item's data is not examined nor are the business of the two HUBs separated. The results are then compared against NAVSUP goals. The tapes cover 3 consecutive quarters starting from October 1990 and running through July 1991.

B. DATA ANALYSIS FOR SHIPMENTS FROM ORIGINATING ACTIVITIES TO A HUB

1. Shipment from Originating Activity to a HUB

Although the length of the time it takes for items to flow directly from the originating activity to the HUB is beyond the control of HUB management, it is a good starting

point to examine the ATAC system. This time begins when a failed DLR's replacement requisition is generated at the originating activity. The date the requisition is created is the earliest date the ATAC system records information about a retrograde DLR. This date is probably a day or two later than the actual failure date of the part due to troubleshooting and processing time at the originating activity.

Appendix B provides the actual record count and percentage distribution for each individual step. The data is presented for each ATAC tape and the combined total. The data for this measurement is presented in Appendix B-1. The observed values for this time ranged from 0 days to greater than 120 days, including weekends. This wide range can be attributed to many factors. If the originating activity is collocated with a HUB it can deliver the part immediately. If it is not collocated it may choose to turn the failed carcass into a local NODE for processing or mail it directly to the nearest HUB. Either of these turn-in procedures will result in a delay before the carcass is received at the HUB.

Longer receipt delays (in excess of 30 days) were generated by deployed ships and parts identified as needing to remain in place (RIP) items until a replacement is received. Another problem is the result of items being processed over the change in fiscal years.

The deployed ships have a longer return pipeline because many of their DLR carcasses being returned from

overseas travel as low priority surface cargo. Items are identified as RIP if removing them creates a safety hazard or completely disables an otherwise partially functional system. A RIP item will have a very long delay time before arriving at a HUB because the replacement parts delivery leadtime is experienced between the time the replacement requisition is submitted and the time the carcass is actually removed and shipped.

An example of a RIP item is a component of the landing gear of a carrier-based aircraft. If this component wears out it must be replaced before the aircraft can be flown again. But, even with the failed component, the aircraft can be towed safely. If the replacement part is not readily available, removing the landing gear requires placing the aircraft on a stand and immobilizing it in the hangar bay. An immobile aircraft creates many problems for the hangar deck crew of a carrier and a great safety hazard if a fire occurs.

One problem, for all the measurements in this thesis, was the result of items that were processed over the change in fiscal years. These items were calculated in the FORTRAN program to have delay times in excess of 600 days. If an item finished a step on Julian date 91002 and started the step on julian date 90360 its delay was calculated at 642 days but the item was really processed in 1 week. Only an insignificant number of observations fell in this category and were excluded.

To eliminate the effect of RIP items, and others whose delay times are difficult to predict and not within the control of the ATAC system, only DLRs having shipment times from the originating activity to a HUB of 0 to 32 days were included in the analysis. This range includes over 420,000 failed DLRs. Approximately 145,000 items being shipped directly to a HUB had shipment times in excess of 30 days. Some of these delays were probably caused by the competition for transportation space and the additional demand created by Operation Desert Shield/Storm.

Figure 4.1 provides a graphic display of the distribution of the number of days required for direct shipment from the original activity to the HUB. The percentage of the recorded observations is presented for each individual ATAC tape as a bar graph, to highlight the routine fluctuations. The tape labeled ATAC 1 includes information on carcasses that arrived at both ATAC HUBs during the first quarter of FY91. The tapes labeled ATAC 2 and ATAC 3 include second and third quarter FY91 arrivals at the ATAC HUBs, respectively. The aggregate total percentage is included as a solid line to separate it. This graph shows that the shipping times are fairly consistent over the quarters as can be seen by the similarity in observations from all three tapes. The average time it took a failed DLR to arrive at a hub was 11 days, but the distribution is interesting. The largest concentration of items arrive at the HUB in one day.

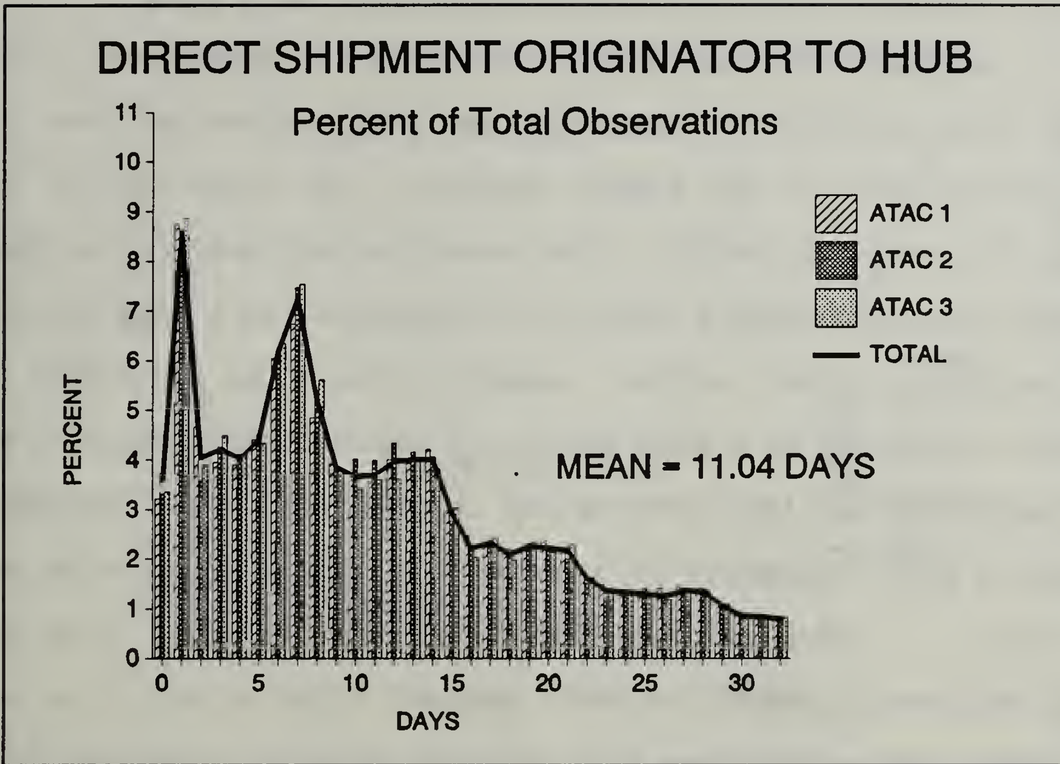

Figure 4.1. Direct Shipment from Originating Activity to a HUB

These are items delivered directly to the HUB by originating activities located in the same port. The next highest portion of items arrive at the HUB in the 6-to-8 day delay range. This data spike is most likely associated with items mailed to the HUBs. However, this is difficult to prove because the data base does not identify the way a carcass arrives at the HUBs. From the author's experience as a destroyer supply officer, we know that many ships return small carcasses by mail because it is the easiest, most expedient way to do it when they are not collocated with a NODE or HUB.

2. Shipment from Originating Activity to a NODE

As described in Chapter II, when a repairable item fails, the originating activity has two choices of how to return the item to the supply system. The first choice is direct delivery to the HUB. The second is delivery to the HUB through the local supply activity, designated as a NODE in the ATAC system. This section examines the time it takes a carcass to arrive at a NODE after the replacement requisition was generated at the originating activity. Items shipped through a NODE represent 24.3 percent of the total records on the tapes. Because this time also includes the time it takes an item to enter the ATAC system, (like direct turn in to a HUB) the range from 0 to 32 days is also presented for this data. This range includes 145,046 failed DLRs and eliminates the long delay items as described in Subsection 1 above.

Figure 4.2 provides a graphic display of the distribution of the number of days required for shipment from the originating activity to a NODE. As with Figure 4.1, the percentage distributions is presented as a bar graph for the individual ATAC tapes and the aggregate total is included as a solid line to highlight it. The data used to generate Figure 4.2 is provided in Appendix B-2.

The average time for shipment from originator to NODE is 8.38 days with about 27% of the items arriving at the NODE in 2 days or less.

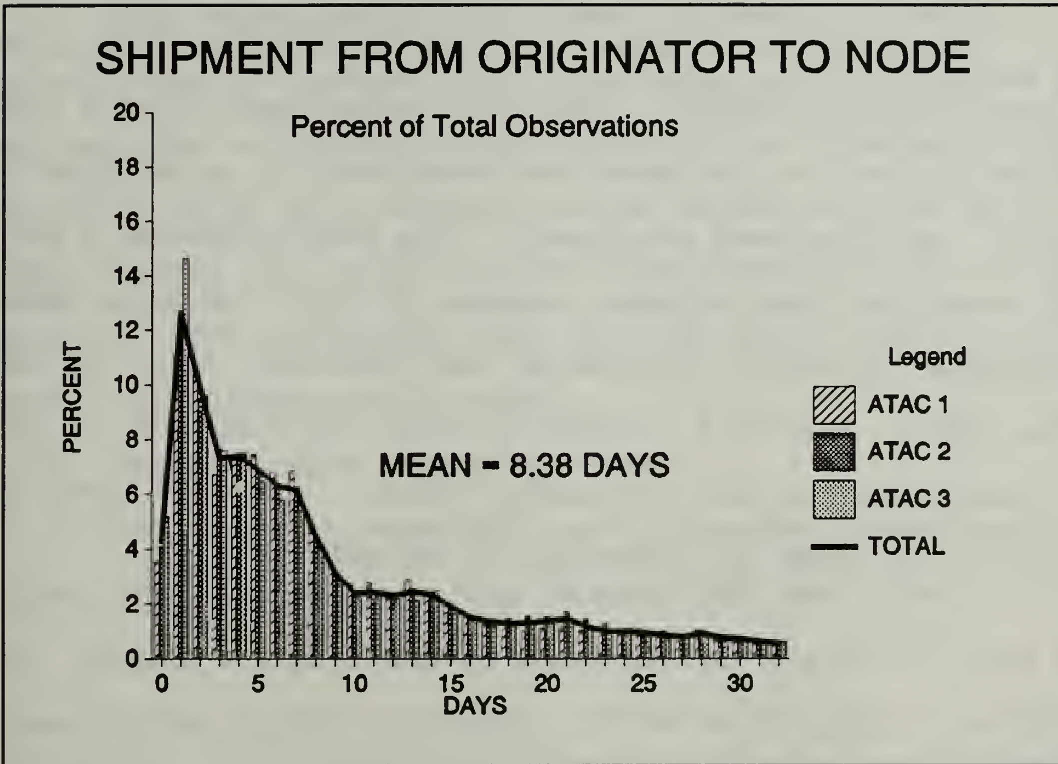

Figure 4.2. Shipment from Originating Activity to a NODE

These failed carcasses are being processed quickly by the originating activity and turned in immediately. Days 3 through 7 account for another 38% of the observations. These shipment times can be caused by various reasons. Ships doing local operations must hold failed DLRs until they return to port because they have no opportunity to transfer them while at sea. Inport workloads can cause DLR turn-ins to be held until a group of them is available to justify the man-hours required to process them. This batch processing violates the spirit of the DLR turn-in process but is a fairly common practice in the fleet. These delays are caused by the same reasons as described in section 1.

3. NODE Consolidation and Processing Time

This section examines the time it takes an item to be processed through a NODE. This time measurement starts when the item arrives at the NODE and ends when it is shipped to the HUB. As discussed previously, the NODE prepares a bar-coded label for the carcass, enters it into the data base, consolidates numerous carcasses and forwards them to the nearest HUB. Figure 4.3 provides the distribution of the NODE consolidation and processing time. The data used to generate this graph is presented in Appendix B-3.

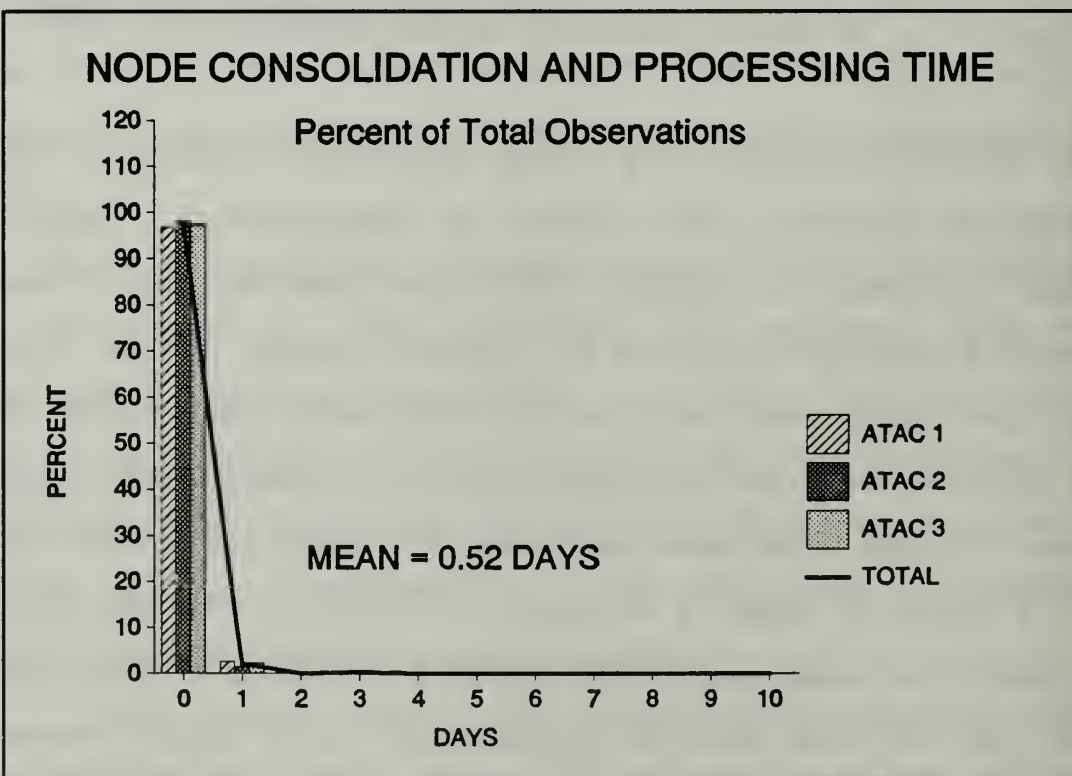

Figure 4.3. NODE Consolidation and Processing Time

This measurement has a mean processing time of 0.52 days with over 97 percent of all carcasses being processed the same day they arrive at the NODE. This data indicates NODE processing works well; almost always making its one day goal set by NAVSUP for consolidating and processing. In most instances, NODE processing does not add significantly to the overall DLR carcass return time.

4. Shipment from a NODE to a HUB

The range of observations for the time for shipping a carcass from the NODE to the nearest HUB was from 0 to 10 days. Figure 4.4 provides of the distribution of the time for shipment from a NODE to A HUB. The data used to generate this graph is presented in Appendix B-4.

This distribution has a mean of 2.53 days with half of the items arriving at the HUB the day they were shipped from the NODE, and almost all arriving within one week.

5. Summary

This section has presented the data for the time from when an item fails at the originating activity until it arrives at an ATAC HUB for screening. Two paths were described. The first was direct shipment from the originator to the HUB which averaged 11.04 days. The second path had a failed carcass being processed through a NODE. This process included shipment to the NODE from the originator which averaged 8.38 days, NODE processing time averaging 0.52 days

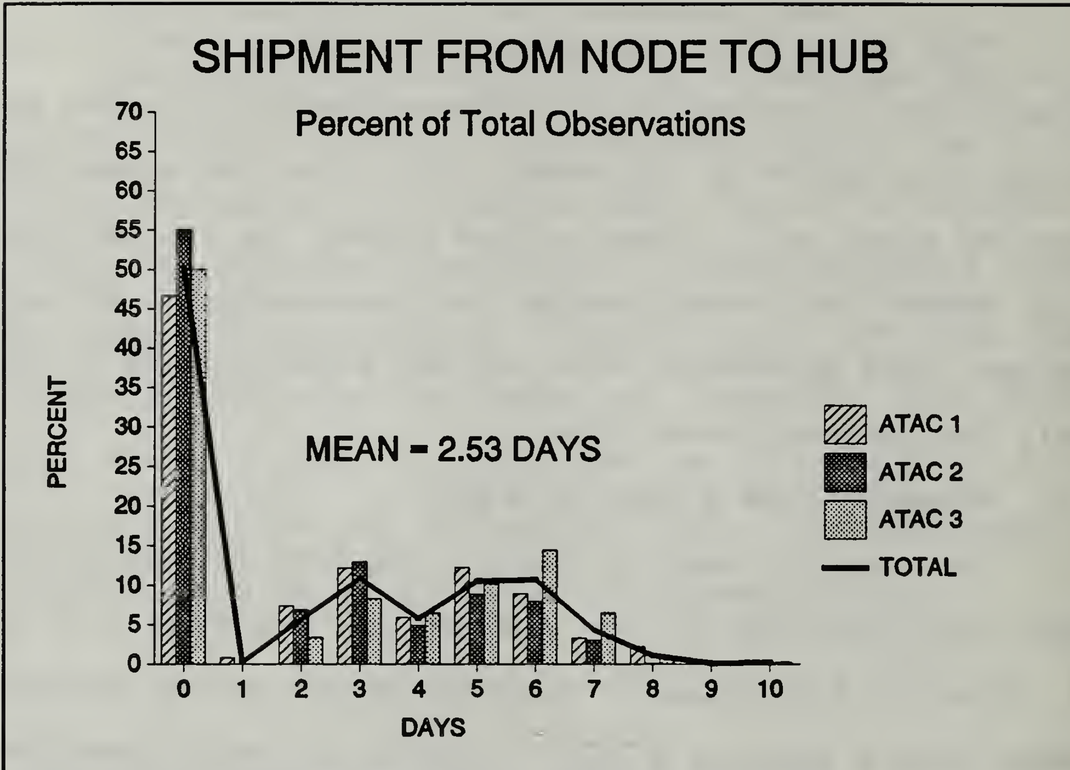

Figure 4.4. Shipment from a NODE to a HUB

and shipment to the nearest HUB which averaged 2.53 days. Thus, the average length of time required for an item processed through a NODE is 11.43 days or just slightly longer than those items shipped directly to a HUB.

C. ACTIVITIES AT A HUB

1. Daily Number of Arrivals at the HUBs

The daily arrivals at the HUBs are the sum of all arrivals at both HUBs from all delivery sources. The data base does not distinguish if a carcass was delivered directly to the HUB, arrives via the U.S. Mail, or has been received through a transshipment from a NODE. This measure represents

the actual demand placed on the ATAC system, and, hence, an estimate of the daily workload. Figure 4.5 displays the frequency distribution for the number of carcasses arriving at the HUBs each day. The x-axis represents the number of daily arrivals and is divided into 100-carcass intervals. Only the low end of the range is labeled on the graph. For example, between 700 and 799 DLRs arrived at the HUBs on 10 separate days.

The y-axis is the number of days that had arrivals in each

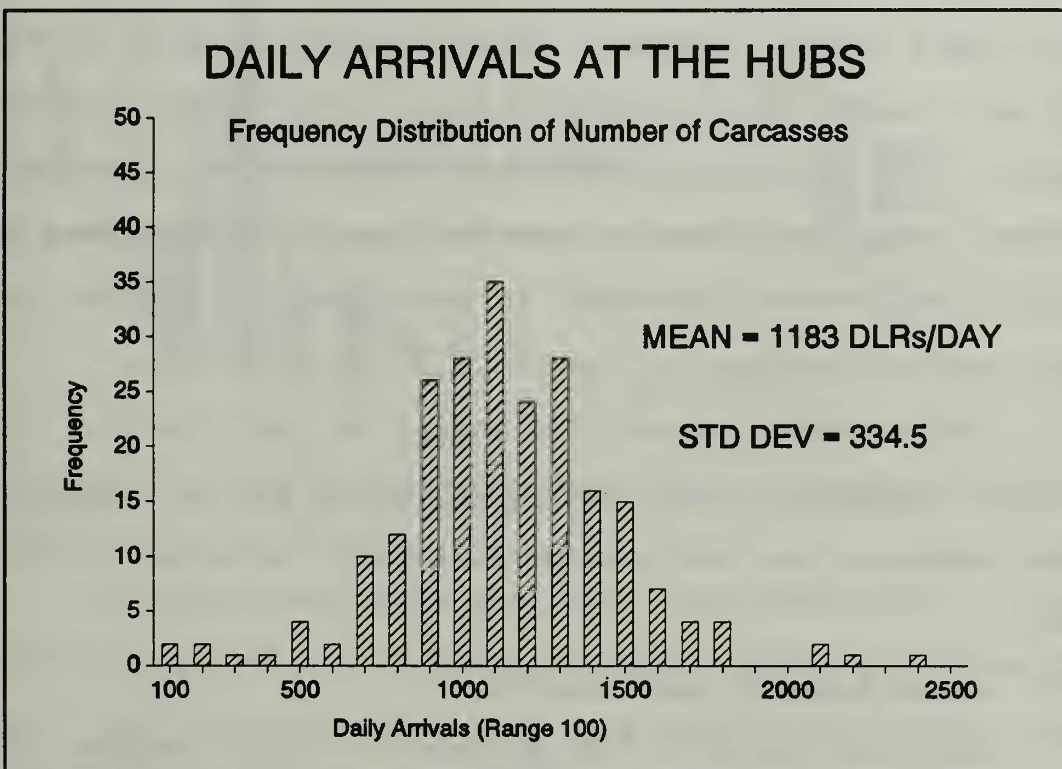

Figure 4.5. Daily Arrivals at the HUBs

x value range, with 225 total working days being tallied. The mean arrival rate is 1183 carcasses per day. The standard deviation of daily arrivals at the HUBs is 334.5. This wide

variation makes workload planning difficult for HUB management. The data this graph is generated from is presented in Appendix B-5.

In the extreme cases, if low quantities continually arrive (a real possibility in the current funding environment) there will be excess capacity, idle personnel, and the cost of processing individual carcasses will increase, because the fixed costs of running the system will be spread over fewer items. If the very high quantities of carcasses arrived continually, additional processing people would be required, adding costs to the system. If more people aren't hired, backlogs of parts to be processed would grow rapidly and the length of time to process individual carcasses would rapidly increase. This could have a negative impact on readiness or require an increased investment in spare parts to support the longer repair pipeline.

The workload capacity planning of the HUBs and the allowable inventory level decisions could be the topic of further research but are considered beyond the scope of this paper.

2. Agent Receipt and Turnover

The next step in the process is agent receipt and turnover. This includes the time it takes the ATAC HUB contractor personnel to enter the DLR carcass' document number and NSN into the data base, prepare a bar code label if the

item had not been processed through a NODE, and turn the item over to NAVY personnel for screening. Figure 4.6 provides the distribution of the time required for the HUB agent to receive and process the DLR. Figure 4.6 is generated from data presented in Appendix B-6.

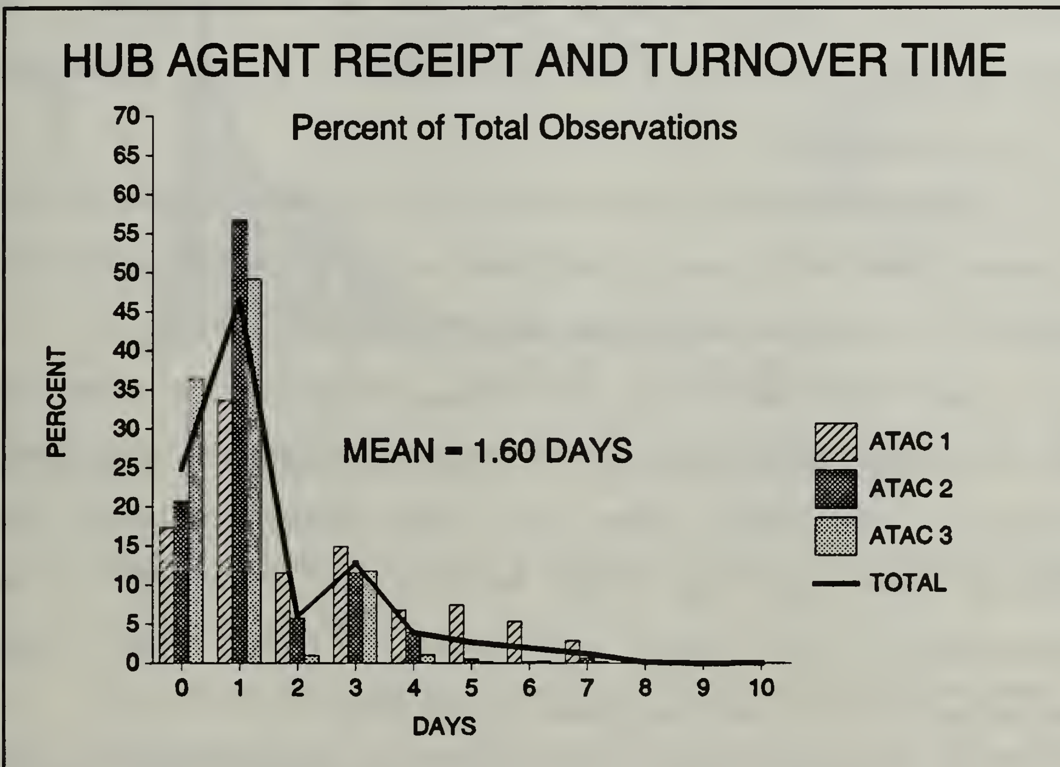

Figure 4.6. HUB Agent Receipt and Turnover Time

The observed data for this measurement had a range from 0 to 10 days. The mean of these observations was 1.6 days. This low value indicates the ATAC HUB contractor does a fairly good job in processing the failed DLR carcasses. The NAVSUP goal for this step is one day. [Ref. 4:p 23]

3. Navy Screening to Stow for Local Stow Items

Navy personnel are responsible for screening, packing, and processing failed DLR carcasses for storage or shipment. This process, described in Chapter II, can take two paths. If an item is determined to require local storage it is sent directly to the local storage facility or to disposal. If immediate repair of the item is required, it is forwarded directly to the DOP.

This sub-section considers only the delay that occurs for those items which are determined to not require immediate shipment to a repair facility.

The NAVY screening personnel identify the item and learn from the MRIL that it is to be stored at the local facility. The total time for this phase includes the screening time and the time waiting for custody to be transferred to the local stockpoint. Local stow items represented 37% of the returned carcasses.

The observed data for this time measurement had a range from 0 to greater than 60 days; ninety-five percent of the items were represented by the range 0 to 20 days and were used in the distribution shown in Figure 4.7. The data for this graph is presented in Appendix B-7. The mean of this sample was 3.98 days which exceeds NAVSUP's goal for this process of 2 days. [Ref. 4:p. 22]

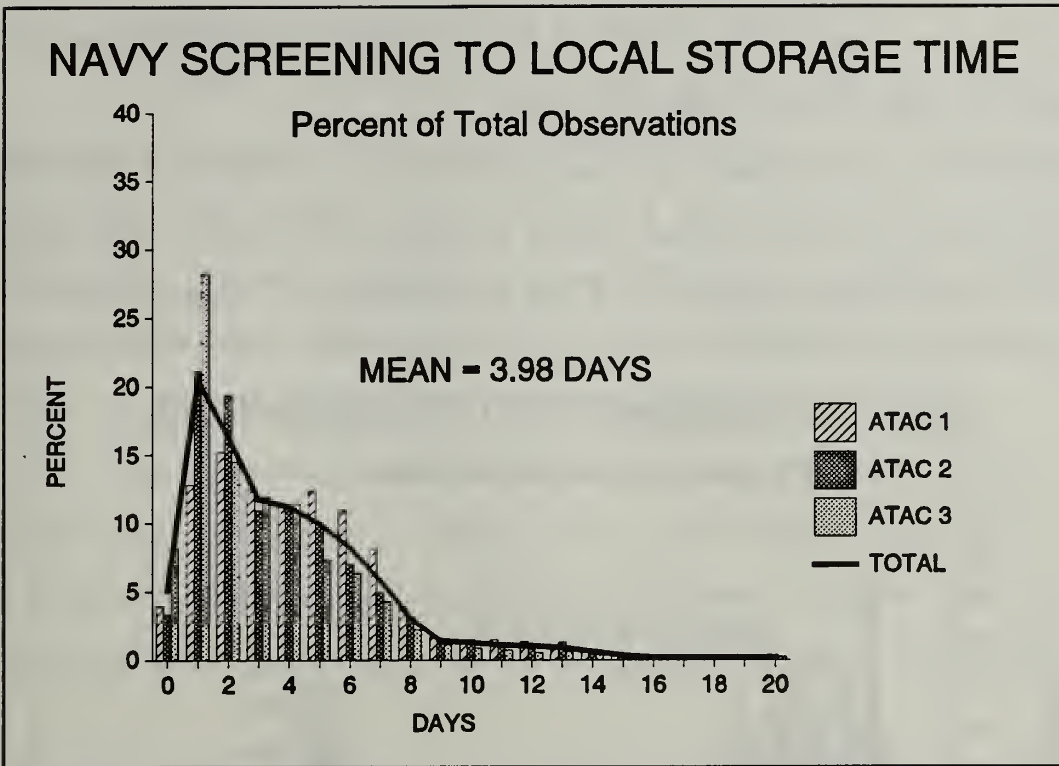

Figure 4.7. Navy Screening to Local Storage Time

4. Navy Screening and Packing Time for Items Being Shipped to DOP

As discussed above, the Navy HUB personnel screen an item to determine if it should be stored locally or forwarded to a DOP for repair. This section discusses the latter items. The observed times for this part of the Navy processing for shipment to a DOP ranged from 0 to greater than 60 days. The few items with long processing times may have been mis-identified by the originating activity or were extremely difficult to identify for HUB personnel. These difficult items require detailed technical research to determine their disposition. This is time-consuming and can account for the

long times observed. To eliminate these outliers, the range from 0 to 21 days was used. This range includes over 93 percent of the total observations.

Figure 4.8 provides the distribution of the Navy screening and packing time for items being shipped to a DOP. The data used in generating Figure 4.8 is presented in Appendix B-8.

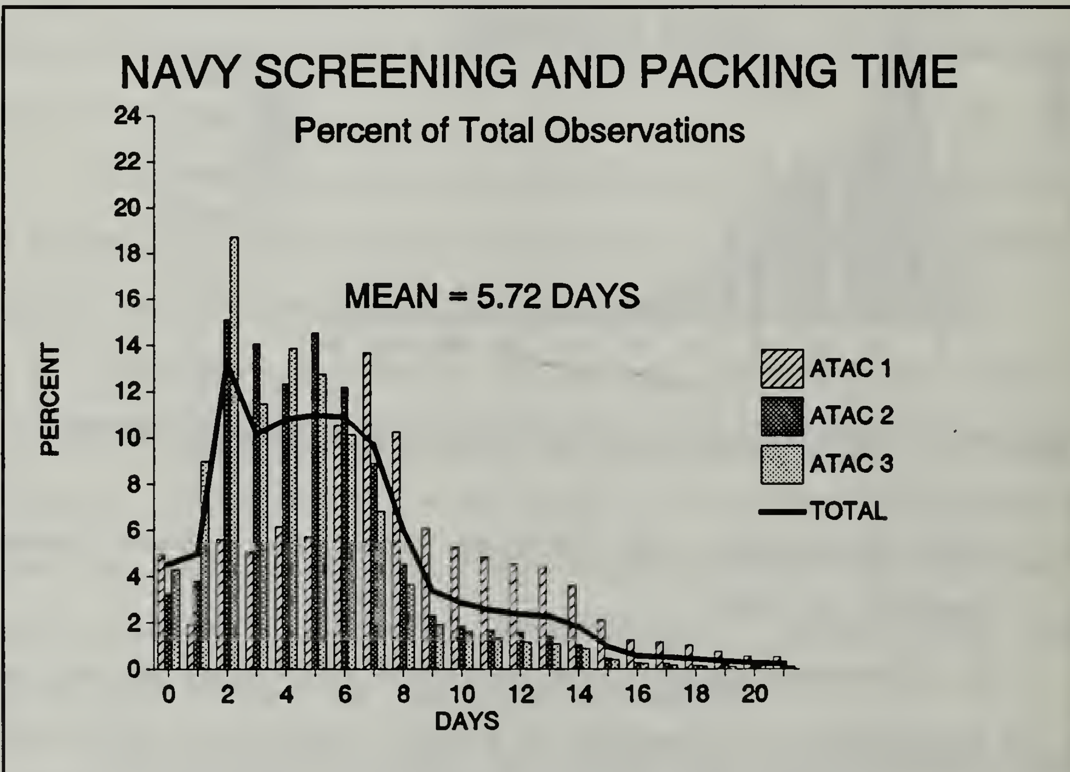

Figure 4.8. Navy Screening and Packing Time

The mean for Navy screening and packing time was 5.7 days which greatly exceeds the NAVSUP goal of 3 days for this phase of the process. [Ref. 4:p 23]

5. Shipment Consolidation Time at the HUB

Shipment consolidation time at the HUB is the time from when the item is returned to ATAC contractor personnel to the time it is turned over to the GTA contractor for shipment to the DOP. This includes time waiting for enough carcasses, destined for the same location, to be processed through the system to take advantage of volume shipping discounts.

The observed consolidation times had a range from 0 to greater than 120 days. Items with long delays were very few and mostly the result of data base problems. These long delay carcasses were excluded from this thesis. Figure 4.9 displays

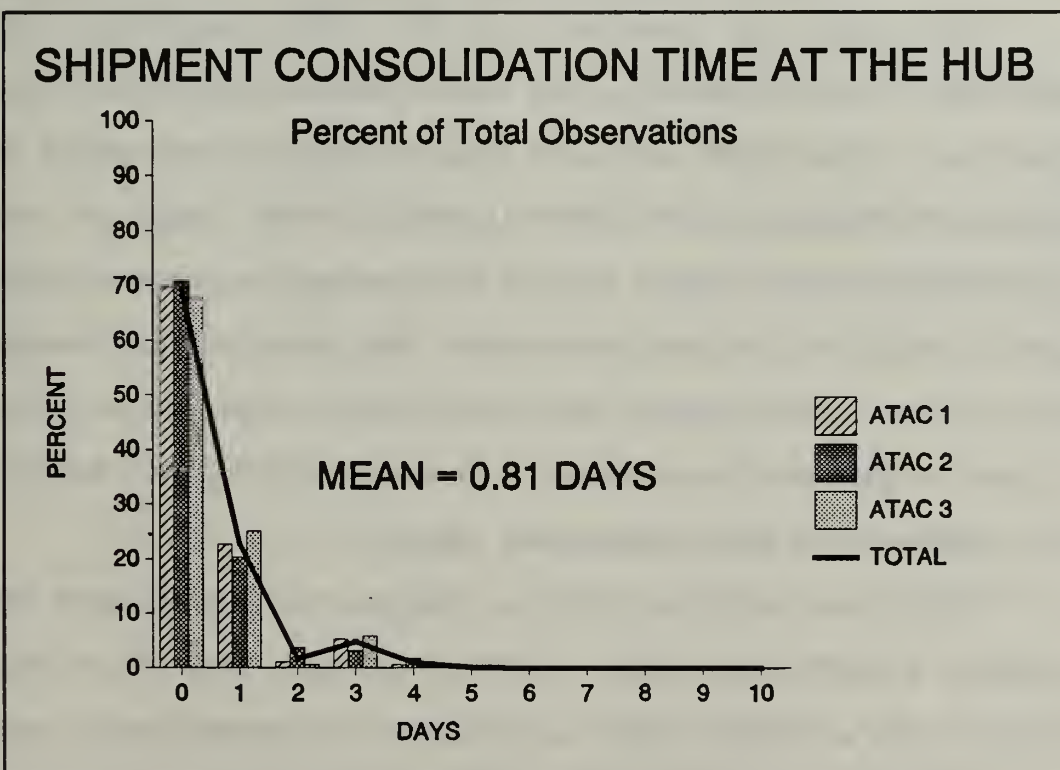

Figure 4.9. Shipment Consolidation Time at the HUB

the range of 0 to 10 days which was used in this measurement. This range included over 90 percent of the items processed for shipment. The data used in generating the graph is presented in Appendix B-9. The mean of the shipment consolidation time at the HUB was 0.81 days which is better than the NAVSUP goal of one day for this process. [Ref.4:p. 23]

6. Shipping Time from HUB to DOP

The amount of time it takes a carcass to be shipped from the HUB to the DOP is the last interval measured by the ATAC system data base. Once an item arrives at the DOP it is no longer tracked by the ATAC system. Any further action taken on the item is directed by the item manager from one of the Navy's Inventory Control Points.

The range of observations for this shipment time ranged from 0 to greater than 120 days. To eliminate bias due to the few items that may have been shipped incorrectly or experienced problems previously discussed, the range of 0 to 12 days was used for Figure 4.10. This range included over 86 percent of the total items processed. The mean of this sample was 4.79 days. The NAVSUP goal for this is five days. The data used to generate the graph is presented in Appendix B-10.

7. Summary of HUB Processing Times

The above sections of this chapter have discussed the processing steps that occur and the average length of time they take from a failed DLR's arrival at the HUBs until it is

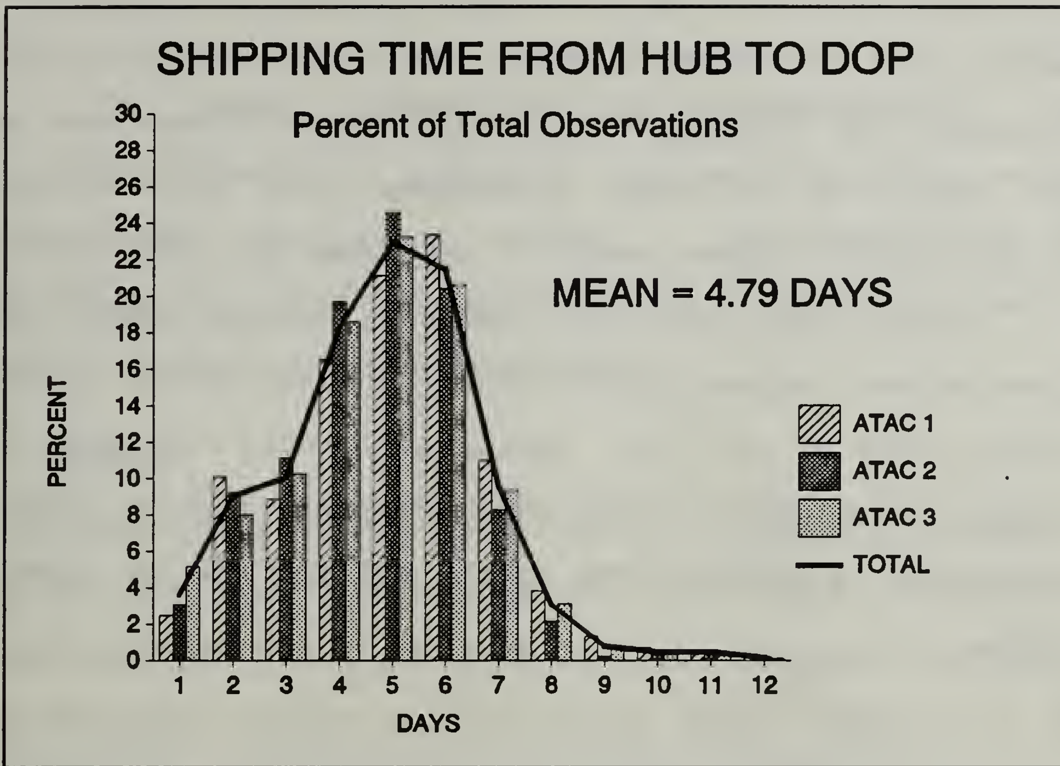

Figure 4.10. Shipping Time from HUB to DOP

stored locally or shipped to a DOP. Two paths were described. The first was processing for an item determined to require local storage. These items accounted for 37 percent of the items examined. Processing time for these items averaged 5.58 days. This included HUB agent receipt and turnover time of 1.6 days and Navy screening time of 3.98 days. This path exceeded the NAVSUP goal of 3 days for this process.

The second path was for items processed through the HUBs and shipped to a DOP. These items accounted for 63 percent of the items examined. Total processing time for these items averaged 12.9 days. This includes the following average times: 1.6 days HUB agent in-processing, 5.7 days

Navy screening and packing, 0.81 days shipment consolidation at the HUB, and 4.79 days shipping time to the DOP. This 12.9 days exceeds the 10-day goal for this process established by NAVSUP, resulting in longer turnaround times for critical items and possibly lower levels of readiness in the fleet.

On both paths the Navy screening process causes the greatest delays, accounting for over 70 percent of the actual processing time at the HUB. Adding additional resources or improving the training current Navy personnel receive should be considered to reduce these delays and shorten the repair pipeline.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter will summarize the previous chapters and present the conclusions reached. Recommendations for continuing the scheduled improvements in the system and for further research are then presented.

A. SUMMARY

Chapter II provided an overview of the Navy's Advanced Traceability and Control System. The flow of DLRs was described from the originating activity through the NODEs to the HUBs and finally to the DOP or DSP. Chapter II also described the various processing steps completed by Navy and contractor personnel for each carcass as it is processed through the HUB.

Chapter III described the ATAC data base and listed the major steps in the system that would be measured. Additionally, Chapter III provided a brief description of ATAC Plus, a series of proposed upgrades to the existing system targeted at improving visibility and accountability throughout the retrograde pipeline.

Chapter IV presented the distributions and averages of actual time delays experienced at each of the processing steps listed in Chapter III, as well as the number of carcasses arriving per day at the HUBs. This data was compared to

NAVSUP goals to determine where improvements in the system should be made and what parts of the system seem to be working well.

B. CONCLUSIONS

What are the current ATAC operating procedures? Do problems exist and what is being done to solve these problems and improve the ATAC system performance? The current operating procedures were described in Chapter II, and a few notable problems exist in the ATAC operating procedures. The primary problem is a lack of visibility for carcasses before they arrive at the NODEs or HUBs. This lack of visibility makes expediting critical requirements very difficult and expensive. The ATAC Plus system, described in Chapter III, is designed to ensure complete visibility for each carcass from the initial point of turn-in by the originating activity to arrival at the DOP/DSP. When implemented this dramatic improvement will allow ICP item managers to easily expedite critical requirements and should shorten repair turnaround time by allowing production planners to schedule work more effectively and order required bit and piece parts earlier.

Is there accurate and detailed data available in the ATAC data base? What are the major steps in the process, and does the data base allow them to be measured? The ATAC data base provides a detailed breakdown of the flow of carcasses through the ATAC system. As discussed in Chapter IV, the data base

appears to track the movement of DLRs through the system from the time they arrive at the HUBs to the time they arrive at the DOP/DSP very well. The data base is designed to allow each to be isolated and measured very easily. The results of the analysis were presented graphically in Chapter IV with the actual data being listed in Appendix B. The time a carcass spends in each step of the system is required to design and validate an elaborate model of the system.

Can a simulation model of the ATAC system be developed? As Jacobs and Dryer demonstrated [Ref. 5], the ATAC process is not a difficult one to model through simulation. The data described in Chapter IV can be used to develop a model that would allow assessing the impact of proposed policy changes NAVSUP may consider in response to DMRD 901. The empirical data distributions will be required to model the ATAC system because no well known distribution patterns fit the observed data.

C. RECOMMENDATIONS

The following are recommendations to improve the ATAC system or to provide areas for further research:

1. Accelerate the implementation of ATAC Plus. The ATAC Plus system will provide significant improvements in DLR processing in the problem areas of visibility, expediting and shortened repair turn-around time. With today's "down" budget climate expected to continue in the future, implementing ATAC

Plus is an inexpensive way to reduce the length of the repairable pipeline and reduce the inventory investment required to support it. Failure to implement this series of low cost improvements will probably have a negative impact on readiness as Navy Stock Fund dollars become more scarce and inventory investment levels decline.

2. The Navy screening portion of the HUB processing needs to be improved. Additional personnel or improved training is required to decrease this delay in carcass processing. Navy screening for local stow items currently averages about 4 days, while screening and packing for items being shipped averages about 6 days, exceeding the NAVSUP goals of 2 and 3 days respectively for these steps. These delay times account for over 70 percent of the time when an item is at the HUB. If additional resources are applied in this point of the process, the length of the pipeline could be shortened and the same level of support be maintained with a lower inventory investment. Some of these delay times may have been caused by added workload generated by Operation Desert Shield/Storm. If this unexpected workload caused the delays, an additional surge capacity may be needed at the HUBs to support critical world events.

3. An elaborate model of the process should be developed to analyze the effects of changes proposed by DMRD 901. The data presented in this thesis and the ATAC tapes it was derived from should provide a sufficient basis to begin the modeling process.

The data on the existing tapes can easily be sorted to identify the performance of a particular HUB or the processing times for the various cognizant groups the Navy manages. Individual items can be traced by stock number or requisition number. This capability might allow the development of a priority system for the HUBs to expedite processing for critically required carcasses.

Additional information required for a model but not available from the tapes are the number of personnel at each HUB, number of work stations or "servers", and the capacity of each HUB.

4. Students doing follow on research to this topic should travel to both HUBs, the ICPs, and possibly NAVSUP. Enough time should be spent at each activity to thoroughly understand the system and determine the additional information required to effectively model the system. Mr. Dave Estep, NAVSUP code 431A, should be contacted to obtain the latest operating procedures for the ATAC system. If additional data is required Mr. Paul Barraco, NAVMTO, Code 033B should be contacted.

APPENDIX A

The following items are designated as ATAC exclusion items and are turned over to Navy personnel immediately upon receipt at the HUB:

1. Aircraft Engines
2. Marine Gas Turbine Engines (Shipboard Propulsion Units)
3. Fleet Ballistic Missile Components
4. Classified/Security Items
5. Redistributed Assets
6. Radiac Material
7. Nuclear Reactor Plant Material
8. Class A, B, and C Explosives
9. Small Arms, Ammunition and Night Vision Devices
10. Uncertified and improperly packaged Hazardous Material
11. Helicopter Gear Boxes
12. Oversized items

APPENDIX B

Appendix B provides the actual DLR requisition count and percentage distributions for each individual ATAC tape and the combined total, the time is in days. The data presented in this appendix was used to generate the graphs presented in Chapter IV.

B-1. Shipment from Originating Activity to a HUB

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	4602	5032	4884	14518
1	12489	10907	12851	36247
2	6675	4842	5646	17163
3	5642	5719	6523	17884
4	5566	5576	5989	17131
5	6305	6121	6314	18740
6	8643	8298	9229	26170
7	9625	10116	10949	30690
8	6927	7051	8159	22137
9	5614	5212	5533	16359
10	5142	5443	4949	15534
11	5065	5408	5236	15709
12	5727	5876	5251	16854
13	5603	5640	5765	17008
14	6014	5439	5552	17005
15	4256	3740	4405	12401
16	3524	2937	2957	9418
17	3230	3098	3524	9852
18	3004	2972	2888	8864
19	3211	2994	3388	9593
20	3376	2978	3094	9448
21	3156	2722	3333	9211
22	2435	2058	2362	6855
23	2091	1674	2015	5780
24	1963	1794	1898	5655
25	1763	1891	1852	5506
26	2007	1583	1725	5315
27	2069	1761	1935	5765
28	1879	1855	1971	5705
29	1489	1431	1594	4514
30	1330	1082	1205	3617
31	1215	1197	1182	3594
32	1170	1003	1196	3369
TOTALS	142807	135450	145354	423611

Shipment from Originating Activity to a HUB

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	3.22%	3.72%	3.36%	3.43%
1	8.75%	8.05%	8.84%	8.56%
2	4.67%	3.57%	3.88%	4.05%
3	3.95%	4.22%	4.49%	4.22%
4	3.90%	4.12%	4.12%	4.04%
5	4.42%	4.52%	4.34%	4.42%
6	6.05%	6.13%	6.35%	6.18%
7	6.74%	7.47%	7.53%	7.24%
8	4.85%	5.21%	5.61%	5.23%
9	3.93%	3.85%	3.81%	3.86%
10	3.60%	4.02%	3.40%	3.67%
11	3.55%	3.99%	3.60%	3.71%
12	4.01%	4.34%	3.61%	3.98%
13	3.92%	4.16%	3.97%	4.02%
14	4.21%	4.02%	3.82%	4.01%
15	2.98%	2.76%	3.03%	2.93%
16	2.47%	2.17%	2.03%	2.22%
17	2.26%	2.29%	2.42%	2.33%
18	2.10%	2.19%	1.99%	2.09%
19	2.25%	2.21%	2.33%	2.26%
20	2.36%	2.20%	2.13%	2.23%
21	2.21%	2.01%	2.29%	2.17%
22	1.71%	1.52%	1.62%	1.62%
23	1.46%	1.24%	1.39%	1.36%
24	1.37%	1.32%	1.31%	1.33%
25	1.23%	1.40%	1.27%	1.30%
26	1.41%	1.17%	1.19%	1.25%
27	1.45%	1.30%	1.33%	1.36%
28	1.32%	1.37%	1.36%	1.35%
29	1.04%	1.06%	1.10%	1.07%
30	0.93%	0.80%	0.83%	0.85%
31	0.85%	0.88%	0.81%	0.85%
32	0.82%	0.74%	0.82%	0.80%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-2. Shipment from Originating Activity to a NODE

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	1602	1982	2658	6242
1	5026	5762	7478	18266
2	4840	4613	4905	14358
3	3060	3709	3873	10642
4	3303	3624	3822	10749
5	3391	3319	3305	10015
6	3116	3083	2961	9160
7	3102	3026	2778	8906
8	2186	2148	2141	6475
9	1585	1542	1451	4578
10	1218	1135	1131	3484
11	1255	1071	1190	3516
12	1080	1150	1105	3335
13	1308	1170	1083	3561
14	1031	1082	1254	3367
15	899	949	942	2790
16	699	756	759	2214
17	620	601	726	1947
18	507	701	658	1866
19	456	751	683	1890
20	495	738	754	1987
21	513	822	749	2084
22	469	686	556	1711
23	387	612	467	1466
24	408	477	562	1447
25	491	487	416	1394
26	400	485	361	1246
27	284	417	444	1145
28	475	421	446	1342
29	356	370	370	1096
30	343	306	387	1036
31	302	278	338	918
32	261	243	309	813
TOTALS	45468	48516	51062	145046

Shipment from Originating Activity to a NODE

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	3.52%	4.09%	5.21%	4.30%
1	11.05%	11.88%	14.64%	12.59%
2	10.64%	9.51%	9.61%	9.90%
3	6.73%	7.64%	7.58%	7.34%
4	7.26%	7.47%	7.49%	7.41%
5	7.46%	6.84%	6.47%	6.90%
6	6.85%	6.35%	5.80%	6.32%
7	6.82%	6.24%	5.44%	6.14%
8	4.81%	4.43%	4.19%	4.46%
9	3.49%	3.18%	2.84%	3.16%
10	2.68%	2.34%	2.21%	2.40%
11	2.76%	2.21%	2.33%	2.42%
12	2.38%	2.37%	2.16%	2.30%
13	2.88%	2.41%	2.12%	2.46%
14	2.27%	2.23%	2.46%	2.32%
15	1.98%	1.96%	1.84%	1.92%
16	1.54%	1.56%	1.49%	1.53%
17	1.36%	1.24%	1.42%	1.34%
18	1.12%	1.44%	1.29%	1.29%
19	1.00%	1.55%	1.34%	1.30%
20	1.09%	1.52%	1.48%	1.37%
21	1.13%	1.69%	1.47%	1.44%
22	1.03%	1.41%	1.09%	1.18%
23	0.85%	1.26%	0.91%	1.01%
24	0.90%	0.98%	1.10%	1.00%
25	1.08%	1.00%	0.81%	0.96%
26	0.88%	1.00%	0.71%	0.86%
27	0.62%	0.86%	0.87%	0.79%
28	1.04%	0.87%	0.87%	0.93%
29	0.78%	0.76%	0.72%	0.76%
30	0.75%	0.63%	0.76%	0.71%
31	0.66%	0.57%	0.66%	0.63%
32	0.57%	0.50%	0.61%	0.56%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-3. NODE Consolidation and Processing Time

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	148679	140468	142777	431924
1	3969	2143	3329	9441
2	65	17	0	82
3	724	516	470	1710
4	49	143	104	296
5	0	0	9	9
6	0	0	0	0
7	17	0	0	17
8	0	2	0	2
9	0	0	0	0
10	0	0	0	0
TOTALS	153503	143289	146689	443481

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	96.86%	98.03%	97.33%	97.39%
1	2.59%	1.50%	2.27%	2.13%
2	0.04%	0.01%	0.00%	0.02%
3	0.47%	0.36%	0.32%	0.39%
4	0.03%	0.10%	0.07%	0.07%
5	0.00%	0.00%	0.01%	0.00%
6	0.00%	0.00%	0.00%	0.00%
7	0.01%	0.00%	0.00%	0.00%
8	0.00%	0.00%	0.00%	0.00%
9	0.00%	0.00%	0.00%	0.00%
10	0.00%	0.00%	0.00%	0.00%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-4. Shipment from a NODE to a HUB

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	30562	27415	34279	92255
1	538	0	0	538
2	4846	3439	2291	10576
3	7944	6460	5644	20049
4	3873	2430	4362	10666
5	8007	4420	6962	19390
6	5855	3959	9845	19659
7	2130	1484	4380	7994
8	1439	45	569	2053
9	143	94	0	238
10	220	63	139	421
TOTALS	65558	49808	68472	183838

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	46.62%	55.04%	50.06%	50.18%
1	0.82%	0.00%	0.00%	0.29%
2	7.39%	6.90%	3.35%	5.75%
3	12.12%	12.97%	8.24%	10.91%
4	5.91%	4.88%	6.37%	5.80%
5	12.21%	8.87%	10.17%	10.55%
6	8.93%	7.95%	14.38%	10.69%
7	3.25%	2.98%	6.40%	4.35%
8	2.20%	0.09%	0.83%	1.12%
9	0.22%	0.19%	0.00%	0.13%
10	0.34%	0.13%	0.20%	0.23%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-5. Daily Arrivals at the HUBs

The RANGE in this table provides the number of DLR carcasses that arrive daily at both the ATAC HUBs. The data is divided into 100 carcass intervals. The frequency is the number of days this many carcasses arrived at the HUBs. The number listed under range is the low value for that range. For example, between 500 and 599 carcasses arrived at the HUBs on 4 separate days.

RANGE	FREQUENCY
100	2
200	2
300	1
400	1
500	4
600	2
700	10
800	12
900	26
1000	28
1100	35
1200	24
1300	28
1400	16
1500	15
1600	7
1700	4
1800	4
1900	0
2000	0
2100	2
2200	1
2300	0
2400	1

B-6. Agent Receipt and Turnover

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	34509	40837	73179	148525
1	67269	111938	98935	278142
2	23103	11331	1899	36333
3	29853	22750	23755	76358
4	13512	7712	2156	23380
5	14950	1065	241	16256
6	10654	355	492	11501
7	5659	1219	238	7116
8	622	163	8	793
9	16	7	3	26
10	19	19	162	200
TOTALS	200166	197396	201068	598630

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	ATAC 4
0	17.24%	20.69%	36.40%	24.81%
1	33.61%	56.71%	49.20%	46.46%
2	11.54%	5.74%	0.94%	6.07%
3	14.91%	11.53%	11.81%	12.76%
4	6.75%	3.91%	1.07%	3.91%
5	7.47%	0.54%	0.12%	2.72%
6	5.32%	0.18%	0.24%	1.92%
7	2.83%	0.62%	0.12%	1.19%
8	0.31%	0.08%	0.00%	0.13%
9	0.01%	0.00%	0.00%	0.00%
10	0.01%	0.01%	0.08%	0.03%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-7. Navy Screening to Stow for Local Stow Items

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	1028	800	1965	3793
1	3363	5072	6824	15259
2	3998	4656	3511	12165
3	3285	2628	2886	8799
4	2944	2664	2766	8374
5	3260	2387	1780	7427
6	2877	1689	1543	6109
7	2132	1195	1026	4353
8	1010	750	536	2296
9	457	340	270	1067
10	377	362	213	952
11	395	261	180	836
12	357	287	134	778
13	230	313	149	692
14	166	195	106	467
15	110	84	85	279
16	70	47	53	170
17	52	91	31	174
18	37	77	41	155
19	45	75	37	157
20	56	65	55	176
TOTALS	26249	24038	24191	74478

Navy Screening to Stow for Local Stow Items

Percentage Distribution

RANGE	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	3.92%	3.33%	8.12%	5.09%
1	12.81%	21.10%	28.21%	20.49%
2	15.23%	19.37%	14.51%	16.33%
3	12.51%	10.93%	11.93%	11.81%
4	11.22%	11.08%	11.43%	11.24%
5	12.42%	9.93%	7.36%	9.97%
6	10.96%	7.03%	6.38%	8.20%
7	8.12%	4.97%	4.24%	5.84%
8	3.85%	3.12%	2.22%	3.08%
9	1.74%	1.41%	1.12%	1.43%
10	1.44%	1.51%	0.88%	1.28%
11	1.50%	1.09%	0.74%	1.12%
12	1.36%	1.19%	0.55%	1.04%
13	0.88%	1.30%	0.62%	0.93%
14	0.63%	0.81%	0.44%	0.63%
15	0.42%	0.35%	0.35%	0.37%
16	0.27%	0.20%	0.22%	0.23%
17	0.20%	0.38%	0.13%	0.23%
18	0.14%	0.32%	0.17%	0.21%
19	0.17%	0.31%	0.15%	0.21%
20	0.21%	0.27%	0.23%	0.24%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-8. Navy Screening and Packing Time for Items to be Shipped

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	5165	3316	4894	13375
1	2005	3858	10256	16119
2	5867	15448	21386	42701
3	5265	14362	13085	32712
4	6423	12580	15849	34852
5	5973	14842	14561	35376
6	10990	12443	11597	35030
7	14288	9085	7802	31175
8	10706	4627	4171	19504
9	6347	2345	2182	10874
10	5478	1854	1837	9169
11	5029	1689	1508	8226
12	4707	1588	1330	7625
13	4607	1439	1235	7281
14	3763	1082	1036	5881
15	2202	470	483	3155
16	1305	274	266	1845
17	1216	263	182	1661
18	1090	159	165	1414
19	794	186	134	1114
20	593	104	163	860
21	560	77	130	767
TOTALS	104373	102091	114252	320716

Navy Screening and Packing Time for Items to be Shipped

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	4.95%	3.25%	4.28%	4.17%
1	1.92%	3.78%	8.98%	5.03%
2	5.62%	15.13%	18.72%	13.31%
3	5.04%	14.07%	11.45%	10.20%
4	6.15%	12.32%	13.87%	10.87%
5	5.72%	14.54%	12.74%	11.03%
6	10.53%	12.19%	10.15%	10.92%
7	13.69%	8.90%	6.83%	9.72%
8	10.26%	4.53%	3.65%	6.08%
9	6.08%	2.30%	1.91%	3.39%
10	5.25%	1.82%	1.61%	2.86%
11	4.82%	1.65%	1.32%	2.56%
12	4.51%	1.56%	1.16%	2.38%
13	4.41%	1.41%	1.08%	2.27%
14	3.61%	1.06%	0.91%	1.83%
15	2.11%	0.46%	0.42%	0.98%
16	1.25%	0.27%	0.23%	0.58%
17	1.17%	0.26%	0.16%	0.52%
18	1.04%	0.16%	0.14%	0.44%
19	0.76%	0.18%	0.12%	0.35%
20	0.57%	0.10%	0.14%	0.27%
21	0.54%	0.08%	0.11%	0.24%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-9. Shipment Consolidation Time at the HUB

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	107540	104243	109315	321098
1	34957	29937	40572	105466
2	1771	5618	1074	8463
3	8150	4726	9541	22417
4	1083	2635	846	4564
5	365	112	68	545
6	96	81	3	180
7	25	24	3	52
8	13	10	4	27
9	8	9	2	19
10	3	2	3	8
TOTALS	154011	147397	161431	462839

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
0	69.83%	70.72%	67.72%	69.38%
1	22.70%	20.31%	25.13%	22.79%
2	1.15%	3.81%	0.67%	1.83%
3	5.29%	3.21%	5.91%	4.84%
4	0.70%	1.79%	0.52%	0.99%
5	0.24%	0.08%	0.04%	0.12%
6	0.06%	0.05%	0.00%	0.04%
7	0.02%	0.02%	0.00%	0.01%
8	0.01%	0.01%	0.00%	0.01%
9	0.01%	0.01%	0.00%	0.00%
10	0.00%	0.00%	0.00%	0.00%
TOTALS	100.00%	100.00%	100.00%	100.00%

B-10. Shipping Time from HUB to DOP

Requisition Count

TIME	ATAC 1	ATAC 2	ATAC 3	TOTAL
1	2250	2676	5342	10268
2	9171	7988	8331	25490
3	8036	9636	10647	28319
4	15054	17037	19333	51424
5	19227	21255	24148	64630
6	21241	17676	21414	60331
7	10001	7163	9718	26882
8	3490	1883	3249	8622
9	1197	215	835	2247
10	618	271	459	1348
11	531	494	285	1310
12	161	160	120	441
TOTALS	90977	86454	103881	281312

Percentage Distribution

TIME	ATAC 1	ATAC 2	ATAC 3	ATAC 4
1	2.47%	3.10%	5.14%	3.65%
2	10.08%	9.24%	8.02%	9.06%
3	8.83%	11.15%	10.25%	10.07%
4	16.55%	19.71%	18.61%	18.28%
5	21.13%	24.59%	23.25%	22.97%
6	23.35%	20.45%	20.61%	21.45%
7	10.99%	8.29%	9.35%	9.56%
8	3.84%	2.18%	3.13%	3.06%
9	1.32%	0.25%	0.80%	0.80%
10	0.68%	0.31%	0.44%	0.48%
11	0.58%	0.57%	0.27%	0.47%
12	0.18%	0.19%	0.12%	0.16%
TOTALS	100.00%	100.00%	100.00%	100.00%

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